

What is claimed is:

1 1. An electro-larynx comprising:

2 A. a waveform generator configured to selectively generate an input signal;

3 B. a linear transducer having a throat engagement portion, said linear transducer
4 configured to receive and transform said input signal into a corresponding output
5 vibration of said throat engagement portion, said output vibration being a
6 substantially linear function of said input signal; and

7 C. a power source.

1 2. An electro-larynx according to claim 1, wherein the linear transducer includes:

2 a. an armature assembly, which receives said input signal and vibrates as a
3 function thereof;

4 b. a suspension assembly coupled to said armature assembly; and

5 c. a coupler disk, as said engagement portion, coupled to said suspension
6 assembly, wherein a vibration in said armature assembly causes a
7 corresponding vibration of said coupler disk.

1 3. An electro-larynx according to claim 2 wherein the suspension assembly is a flexible
2 planar membrane.

1 4. An electro-larynx according to claim 2 wherein the suspension assembly is a mechanical
2 spring.

1 5. An electro-larynx according to claim 2 wherein the armature assembly is substantially
2 disposed within a cylindrical motor assembly that defines an internal void region along a
3 central axis and having an radial magnetic field maintained within said internal void
4 region, and wherein said armature assembly includes:

5 a. a bobbin coupled to said suspension assembly and disposed within said
6 internal void region and along said central axis; and
7 b. a wire coil wrapped around said bobbin and within said magnetic field;
8 whereby when said input signal is applied to said wire coil a corresponding vibration of
9 said bobbin is experienced.

1 6. An electro-larynx according to claim 2 wherein the armature assembly includes a piezo-
2 electric actuator coupled to said engagement portion, wherein an input signal delivered to
3 said piezo-electric actuator causes a corresponding linear vibration of said engagement
4 portion.

1 7. An electro-larynx according to claim 2 wherein the armature assembly includes a
2 magneto-resistive element coupled to said engagement portion, wherein an input signal
3 delivered to said magneto-resistive element causes a corresponding linear vibration of
4 said engagement portion.

1 8. An electro-larynx according to claim 1 wherein the linear transducer has a substantially
2 flat frequency response over a range of about 20 to 2KHz.

1 9. An electro-larynx according to claim 1 wherein said input signal generated by said
2 waveform generator has a harmonic structure corresponding to a normal glottal
3 excitation, defined over multiple cycles.

1 10. An electro-larynx according to claim 1 wherein the waveform generator includes:
2 a. glottal sample data stored in an electronic memory;
3 b. a pitch adjuster, configured to add pitch information to said glottal sample
4 data;
5 c. a multiplier, configured to add amplitude information to said glottal
6 sample data;

- 7 d. an equalization filter for generating from said glottal sample data, pitch
8 information, and amplitude information a base digital input signal having
9 a predetermined frequency response; and
10 e. a digital to analog converter, configured to transform said base digital
11 input signal into said input signal.

1 11. An electro-larynx according to claim 10 wherein the glottal sample data is obtained by
2 inverse filtering and digitally sampling voice data.

1 12. A linear transducer, for use in an electro-larynx having a waveform generator that
2 produces an input signal and a power source, said linear transducer comprising:
3 A. an armature assembly, which receives said input signal and vibrates as a function
4 thereof;
5 B. a suspension assembly coupled to said armature assembly; and
6 C. a coupler disk, coupled to said suspension assembly, wherein a vibration in said
7 armature assembly causes a corresponding vibration of said coupler disk
8 according to a linear function of said input signal

1 13. A linear transducer according to claim 12 wherein the suspension assembly is a flexible
2 planar membrane.

1 14. A linear transducer according to claim 12 wherein the suspension assembly is a
2 mechanical spring.

1 15. A linear transducer according to claim 12 wherein the armature assembly is substantially
2 disposed within a cylindrical motor assembly that defines an internal void region along a
3 central axis and having a magnetic field maintained with said internal void region, and
4 wherein said armature assembly includes:

- 5 a. a bobbin coupled to said suspension assembly and disposed within said
6 internal void region and along said central axis; and
7 b. a wire coil wrapped around said bobbin and within said magnetic field;
8 whereby when said input signal is applied to said wire coil a corresponding vibration of
9 said bobbin is experienced.

1 16. A linear transducer according to claim 12 wherein the armature assembly includes a
2 piezo-electric actuator coupled to said coupler disk, wherein an input signal delivered to
3 said piezo-electric actuator causes a corresponding linear vibration of said coupler disk.

1 17. A linear transducer according to claim 12 wherein the armature assembly includes a
2 magneto-resistive element coupled to said coupler disk, wherein an input signal delivered
3 to said magneto-resistive element causes a corresponding linear vibration of said coupler
4 disk.

1 18. A linear transducer according to claim 12 wherein the linear transducer has a substantially
2 flat frequency response over a range of about 20 to 2KHz.

1 19. A waveform generator, for use as part of an electro-larynx having a transducer and a
2 power supply, wherein said waveform generator includes:

- 3 A. glottal sample data stored in an electronic memory, wherein said glottal sample
4 data is defined over multiple cycles;
- 5 B. a pitch adjuster, configured to add pitch information to said glottal sample data;
- 6 C. a mixer, configured to add amplitude information to said glottal sample data;
- 7 D. an equalization filter for generating from said glottal sample data, pitch
8 information, and amplitude information a base digital input signal having a
9 predetermined frequency response; and
- 10 E. a digital to analog converter, configured to transform said base digital input signal
11 into an input signal for use by the transducer.

- 1 20. A waveform generator according to claim 19 wherein the glottal sample data is obtained
2 by inverse filtering and digitally sampling voice data.
- 1 21. A waveform generator according to claim 19 wherein the glottal sample data is derived
2 from a mathematical model which preserves the harmonic qualities of the voice data.
- 1 22. An electro-larynx comprising:
2 A. a waveform generator configured to selectively generate an input signal, wherein
3 said input signal has a harmonic structure corresponding to a normal glottal
4 excitation, defined over multiple cycles;
5 B. a transducer having a throat engagement portion, said transducer configured to
6 receive and transform said input signal into a corresponding output vibration of
7 said throat engagement portion; and
8 C. a power source.
- 1 23. An electro-larynx according to claim 22 wherein the waveform generator includes:
2 a. glottal sample data stored in an electronic memory;
3 b. a pitch adjuster, configured to add pitch information to said glottal sample
4 data;
5 c. a multiplier, configured to add amplitude information to said glottal
6 sample data;
7 d. an equalization filter for generating from said glottal sample data, pitch
8 information, and amplitude information a base digital input signal having
9 a predetermined frequency response; and
10 e. a digital to analog converter, configured to transform said base digital
11 input signal into said input signal.

